US009471856B2

(12) **United States Patent**
Saeki et al.

(10) **Patent No.: US 9,471,856 B2**
(45) **Date of Patent: Oct. 18, 2016**

(54) **METHOD AND APPARATUS FOR PROCESSING INFORMATION, AND COMPUTER-READABLE STORAGE MEDIUM**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/464,031**

(22) Filed: **Aug. 20, 2014**

(65) **Prior Publication Data**

US 2015/0055156 A1 Feb. 26, 2015

(30) **Foreign Application Priority Data**

Aug. 23, 2013 (JP) 2013-173199
Jul. 30, 2014 (JP) 2014-155475

(51) **Int. Cl.**
G06K 15/00 (2006.01)
G06K 15/02 (2006.01)

(52) **U.S. Cl.**
CPC ***G06K 15/1848*** (2013.01); ***G06K 15/1822*** (2013.01)

(58) **Field of Classification Search**
CPC G06K 15/1846; G06K 15/1843; G06K 15/1847; G06K 9/00463; G06K 9/344; G06K 9/78; H04N 2201/3266
USPC 358/1.2, 1.11, 1.15
See application file for complete search history.

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(57) **ABSTRACT**

An information processing apparatus for processing print data includes an extracting unit that extracts characters to be printed and coordinate information of the characters from the print data; an organizing unit that reorganizes the characters extracted by the extracting unit using the coordinate information of the characters; a sorting unit that sorts the characters extracted by the extracting unit into corresponding horizontal or vertical lines using the coordinate information of the characters; and a concatenating unit that concatenates the characters reorganized by the organizing unit and sorted by the sorting unit.

16 Claims, 11 Drawing Sheets

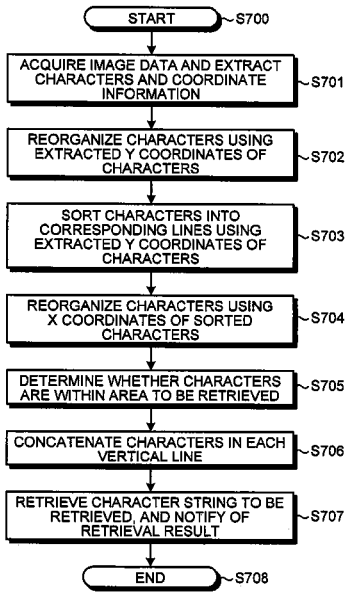


FIG.1

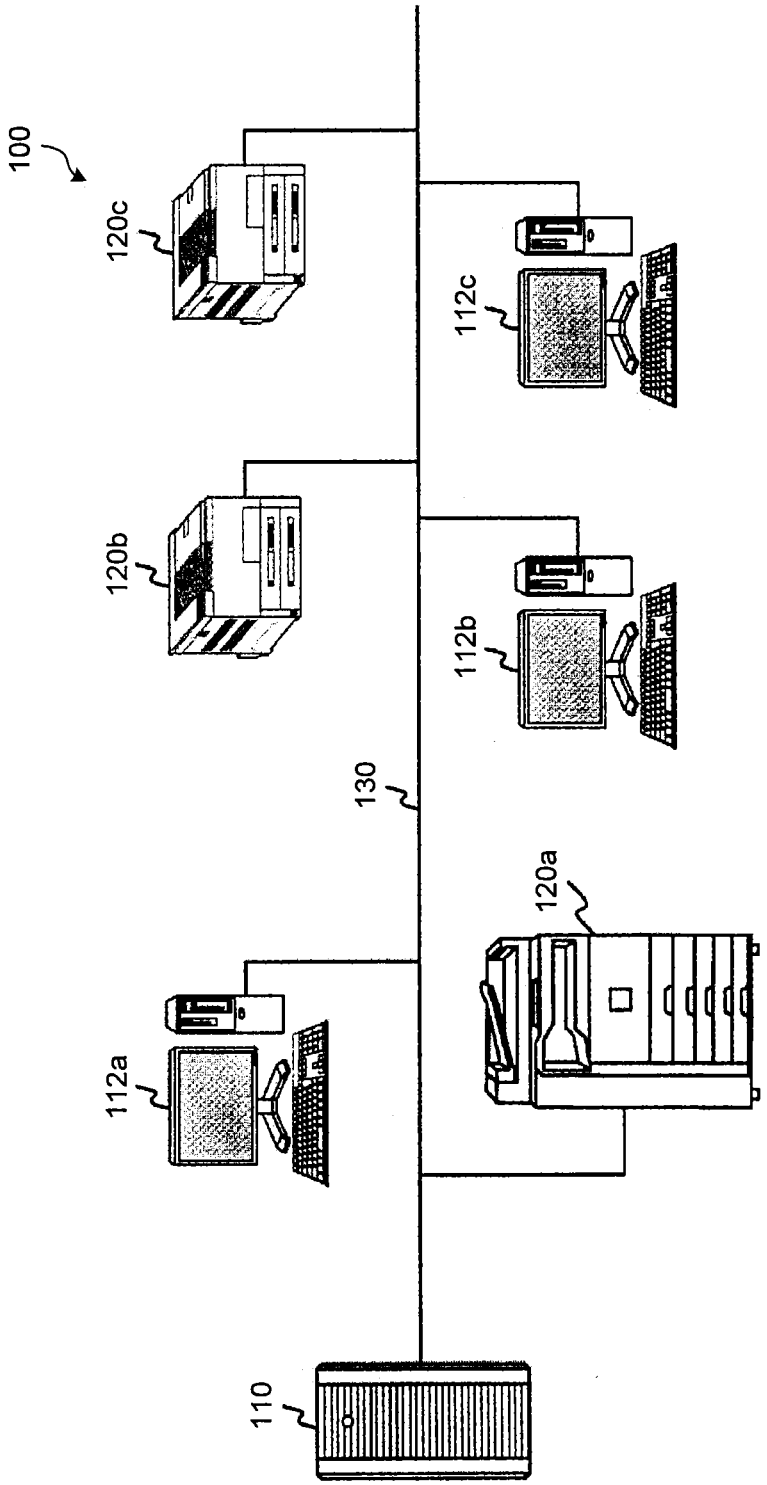


FIG.2

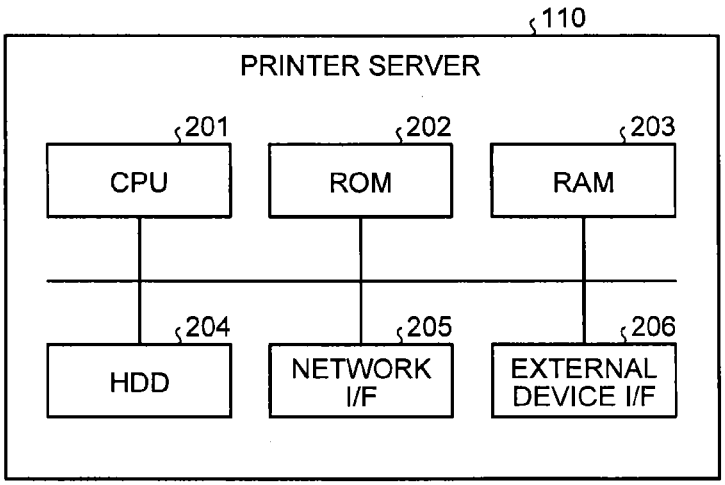

110
PRINTER SERVER
201
CPU
202
ROM
203
RAM
204
HDD
205
NETWORK I/F
206
EXTERNAL DEVICE I/F

FIG.3

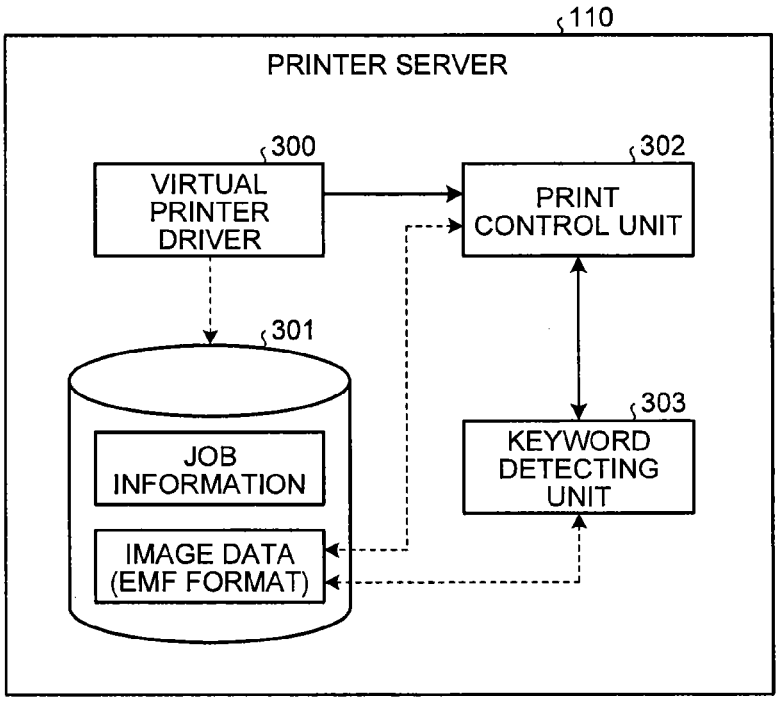

110
PRINTER SERVER
300
VIRTUAL PRINTER DRIVER
302
PRINT CONTROL UNIT
301
303
KEYWORD DETECTING UNIT
JOB INFORMATION
IMAGE DATA (EMF FORMAT)

FIG.4

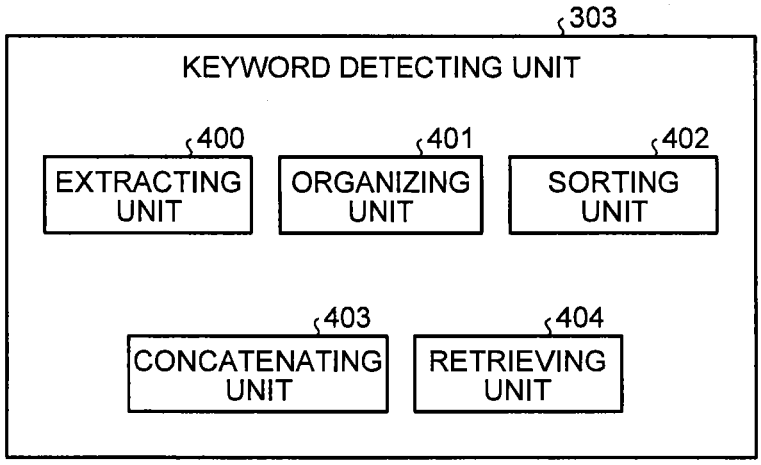

303
KEYWORD DETECTING UNIT
400
EXTRACTING UNIT
401
ORGANIZING UNIT
402
SORTING UNIT
403
CONCATENATING UNIT
404
RETRIEVING UNIT

FIG.5

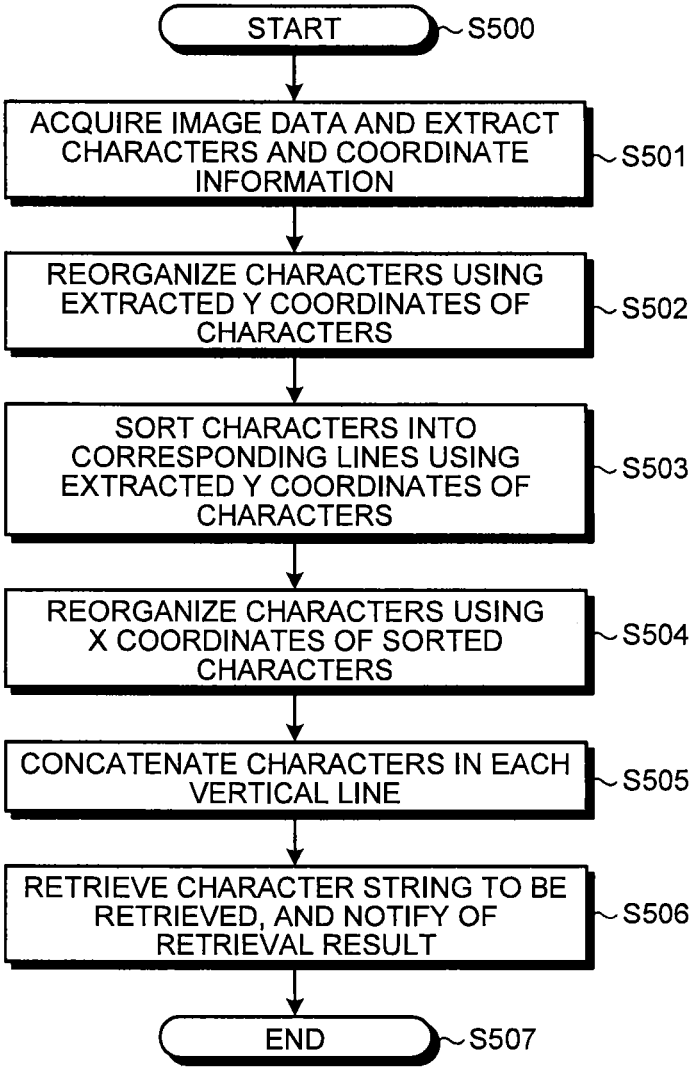

START
S500
ACQUIRE IMAGE DATA AND EXTRACT CHARACTERS AND COORDINATE INFORMATION
S501
REORGANIZE CHARACTERS USING EXTRACTED Y COORDINATES OF CHARACTERS
S502
SORT CHARACTERS INTO CORRESPONDING LINES USING EXTRACTED Y COORDINATES OF CHARACTERS
S503
REORGANIZE CHARACTERS USING X COORDINATES OF SORTED CHARACTERS
S504
CONCATENATE CHARACTERS IN EACH VERTICAL LINE
S505
RETRIEVE CHARACTER STRING TO BE RETRIEVED, AND NOTIFY OF RETRIEVAL RESULT
S506
END
S507

FIG.6

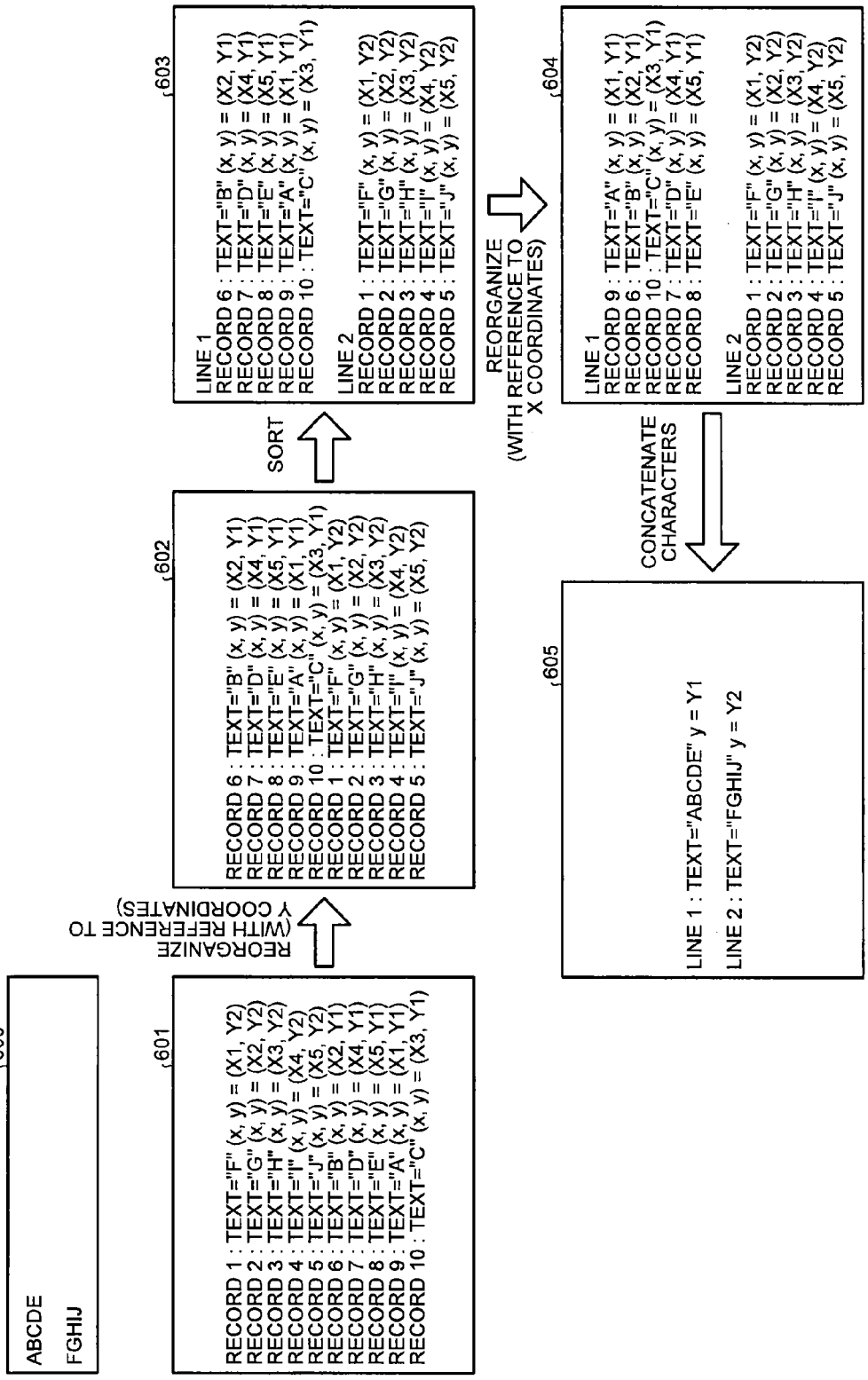

600
ABCDE
FGHIJ
601
RECORD 1 : TEXT="F" (x, y) = (X1, Y2)
RECORD 2 : TEXT="G" (x, y) = (X2, Y2)
RECORD 3 : TEXT="H" (x, y) = (X3, Y2)
RECORD 4 : TEXT="I" (x, y) = (X4, Y2)
RECORD 5 : TEXT="J" (x, y) = (X5, Y2)
RECORD 6 : TEXT="B" (x, y) = (X2, Y1)
RECORD 7 : TEXT="D" (x, y) = (X4, Y1)
RECORD 8 : TEXT="E" (x, y) = (X5, Y1)
RECORD 9 : TEXT="A" (x, y) = (X1, Y1)
RECORD 10 : TEXT="C" (x, y) = (X3, Y1)
REORGANIZE (WITH REFERENCE TO Y COORDINATES)
602
RECORD 6 : TEXT="B" (x, y) = (X2, Y1)
RECORD 7 : TEXT="D" (x, y) = (X4, Y1)
RECORD 8 : TEXT="E" (x, y) = (X5, Y1)
RECORD 9 : TEXT="A" (x, y) = (X1, Y1)
RECORD 10 : TEXT="C" (x, y) = (X3, Y1)
RECORD 1 : TEXT="F" (x, y) = (X1, Y2)
RECORD 2 : TEXT="G" (x, y) = (X2, Y2)
RECORD 3 : TEXT="H" (x, y) = (X3, Y2)
RECORD 4 : TEXT="I" (x, y) = (X4, Y2)
RECORD 5 : TEXT="J" (x, y) = (X5, Y2)
SORT
603
LINE 1
RECORD 6 : TEXT="B" (x, y) = (X2, Y1)
RECORD 7 : TEXT="D" (x, y) = (X4, Y1)
RECORD 8 : TEXT="E" (x, y) = (X5, Y1)
RECORD 9 : TEXT="A" (x, y) = (X1, Y1)
RECORD 10 : TEXT="C" (x, y) = (X3, Y1)
LINE 2
RECORD 1 : TEXT="F" (x, y) = (X1, Y2)
RECORD 2 : TEXT="G" (x, y) = (X2, Y2)
RECORD 3 : TEXT="H" (x, y) = (X3, Y2)
RECORD 4 : TEXT="I" (x, y) = (X4, Y2)
RECORD 5 : TEXT="J" (x, y) = (X5, Y2)
REORGANIZE (WITH REFERENCE TO X COORDINATES)
604
LINE 1
RECORD 9 : TEXT="A" (x, y) = (X1, Y1)
RECORD 6 : TEXT="B" (x, y) = (X2, Y1)
RECORD 10 : TEXT="C" (x, y) = (X3, Y1)
RECORD 7 : TEXT="D" (x, y) = (X4, Y1)
RECORD 8 : TEXT="E" (x, y) = (X5, Y1)
LINE 2
RECORD 1 : TEXT="F" (x, y) = (X1, Y2)
RECORD 2 : TEXT="G" (x, y) = (X2, Y2)
RECORD 3 : TEXT="H" (x, y) = (X3, Y2)
RECORD 4 : TEXT="I" (x, y) = (X4, Y2)
RECORD 5 : TEXT="J" (x, y) = (X5, Y2)
CONCATENATE CHARACTERS
605
LINE 1 : TEXT="ABCDE" y = Y1
LINE 2 : TEXT="FGHIJ" y = Y2

FIG.7

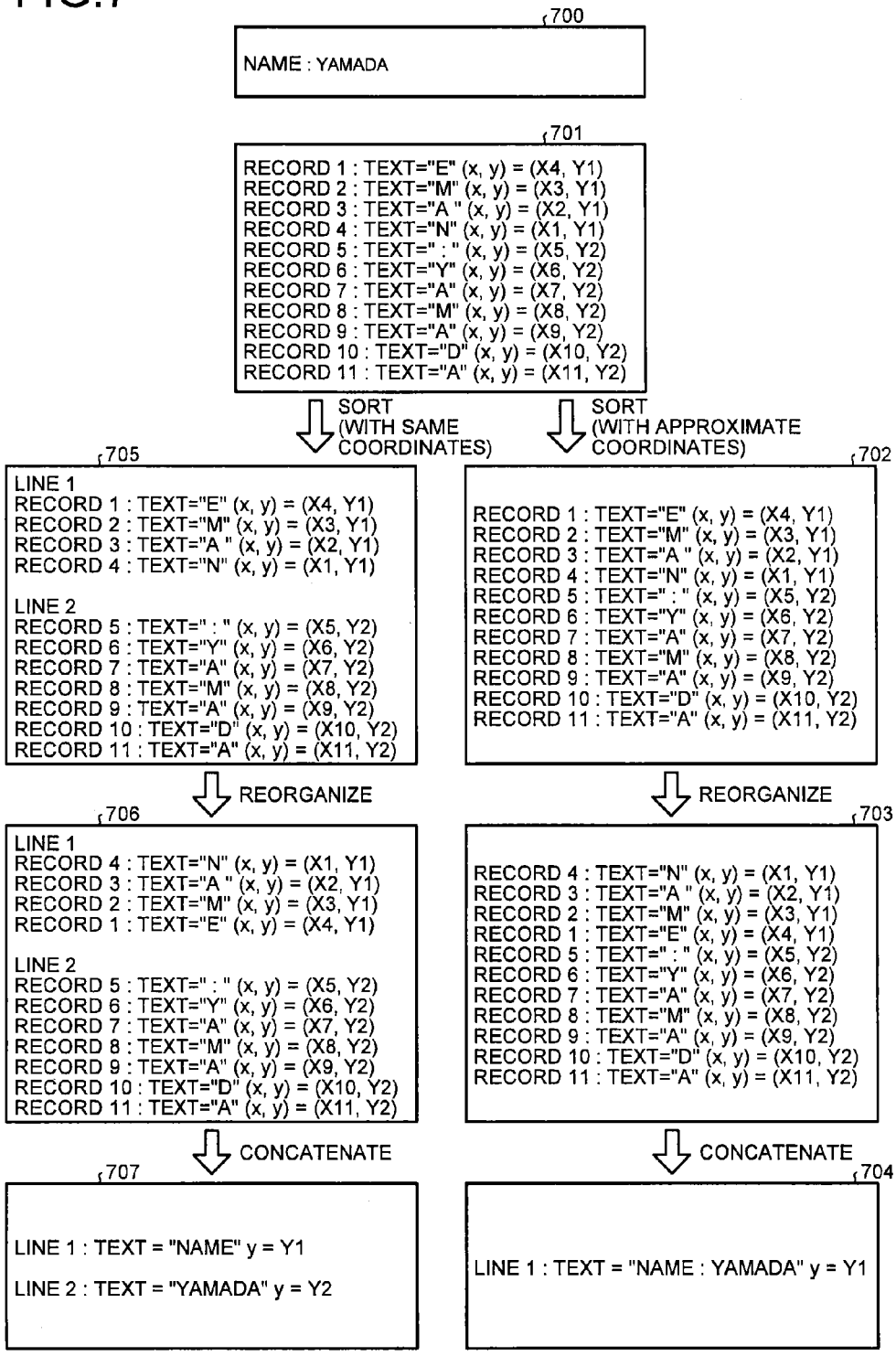

700
NAME : YAMADA
701
RECORD 1 : TEXT="E" (x, y) = (X4, Y1)
RECORD 2 : TEXT="M" (x, y) = (X3, Y1)
RECORD 3 : TEXT="A " (x, y) = (X2, Y1)
RECORD 4 : TEXT="N" (x, y) = (X1, Y1)
RECORD 5 : TEXT=" : " (x, y) = (X5, Y2)
RECORD 6 : TEXT="Y" (x, y) = (X6, Y2)
RECORD 7 : TEXT="A" (x, y) = (X7, Y2)
RECORD 8 : TEXT="M" (x, y) = (X8, Y2)
RECORD 9 : TEXT="A" (x, y) = (X9, Y2)
RECORD 10 : TEXT="D" (x, y) = (X10, Y2)
RECORD 11 : TEXT="A" (x, y) = (X11, Y2)
SORT (WITH SAME COORDINATES)
SORT (WITH APPROXIMATE COORDINATES)
705
LINE 1
RECORD 1 : TEXT="E" (x, y) = (X4, Y1)
RECORD 2 : TEXT="M" (x, y) = (X3, Y1)
RECORD 3 : TEXT="A " (x, y) = (X2, Y1)
RECORD 4 : TEXT="N" (x, y) = (X1, Y1)
LINE 2
RECORD 5 : TEXT=" : " (x, y) = (X5, Y2)
RECORD 6 : TEXT="Y" (x, y) = (X6, Y2)
RECORD 7 : TEXT="A" (x, y) = (X7, Y2)
RECORD 8 : TEXT="M" (x, y) = (X8, Y2)
RECORD 9 : TEXT="A" (x, y) = (X9, Y2)
RECORD 10 : TEXT="D" (x, y) = (X10, Y2)
RECORD 11 : TEXT="A" (x, y) = (X11, Y2)
702
RECORD 1 : TEXT="E" (x, y) = (X4, Y1)
RECORD 2 : TEXT="M" (x, y) = (X3, Y1)
RECORD 3 : TEXT="A " (x, y) = (X2, Y1)
RECORD 4 : TEXT="N" (x, y) = (X1, Y1)
RECORD 5 : TEXT=" : " (x, y) = (X5, Y2)
RECORD 6 : TEXT="Y" (x, y) = (X6, Y2)
RECORD 7 : TEXT="A" (x, y) = (X7, Y2)
RECORD 8 : TEXT="M" (x, y) = (X8, Y2)
RECORD 9 : TEXT="A" (x, y) = (X9, Y2)
RECORD 10 : TEXT="D" (x, y) = (X10, Y2)
RECORD 11 : TEXT="A" (x, y) = (X11, Y2)
REORGANIZE
REORGANIZE
706
LINE 1
RECORD 4 : TEXT="N" (x, y) = (X1, Y1)
RECORD 3 : TEXT="A " (x, y) = (X2, Y1)
RECORD 2 : TEXT="M" (x, y) = (X3, Y1)
RECORD 1 : TEXT="E" (x, y) = (X4, Y1)
LINE 2
RECORD 5 : TEXT=" : " (x, y) = (X5, Y2)
RECORD 6 : TEXT="Y" (x, y) = (X6, Y2)
RECORD 7 : TEXT="A" (x, y) = (X7, Y2)
RECORD 8 : TEXT="M" (x, y) = (X8, Y2)
RECORD 9 : TEXT="A" (x, y) = (X9, Y2)
RECORD 10 : TEXT="D" (x, y) = (X10, Y2)
RECORD 11 : TEXT="A" (x, y) = (X11, Y2)
703
RECORD 4 : TEXT="N" (x, y) = (X1, Y1)
RECORD 3 : TEXT="A " (x, y) = (X2, Y1)
RECORD 2 : TEXT="M" (x, y) = (X3, Y1)
RECORD 1 : TEXT="E" (x, y) = (X4, Y1)
RECORD 5 : TEXT=" : " (x, y) = (X5, Y2)
RECORD 6 : TEXT="Y" (x, y) = (X6, Y2)
RECORD 7 : TEXT="A" (x, y) = (X7, Y2)
RECORD 8 : TEXT="M" (x, y) = (X8, Y2)
RECORD 9 : TEXT="A" (x, y) = (X9, Y2)
RECORD 10 : TEXT="D" (x, y) = (X10, Y2)
RECORD 11 : TEXT="A" (x, y) = (X11, Y2)
CONCATENATE
CONCATENATE
707
LINE 1 : TEXT = "NAME" y = Y1
LINE 2 : TEXT = "YAMADA" y = Y2
704
LINE 1 : TEXT = "NAME : YAMADA" y = Y1

FIG.8

DISPLAY IMAGE

ABCDE

FGHIJ

PRINT DATA (EMF FORMAT)

RECORD 1 : TEXT="F" (x, y) = (X1, Y2)
RECORD 2 : TEXT="G" (x, y) = (X2, Y2)
RECORD 3 : TEXT="H" (x, y) = (X3, Y2)
RECORD 4 : TEXT="I" (x, y) = (X4, Y2)
RECORD 5 : TEXT="J" (x, y) = (X5, Y2)
RECORD 6 : TEXT="B" (x, y) = (X2, Y1)
RECORD 7 : TEXT="D" (x, y) = (X4, Y1)
RECORD 8 : TEXT="E" (x, y) = (X5, Y1)
RECORD 9 : TEXT="A" (x, y) = (X1, Y1)
RECORD 10 : TEXT="C" (x, y) = (X3, Y1)

FIG.9

605a

TEXT="ABCDEFGHIJ"

FIG.10

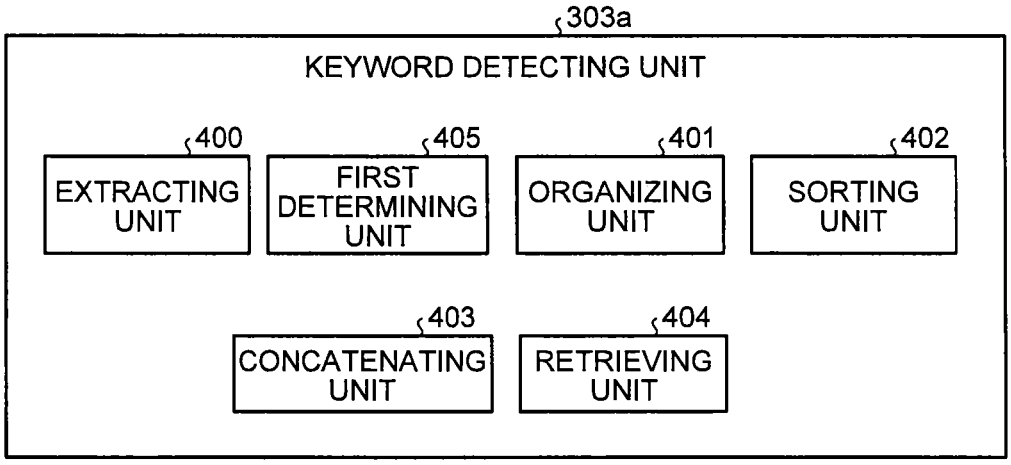

303a
KEYWORD DETECTING UNIT
400
EXTRACTING UNIT
405
FIRST DETERMINING UNIT
401
ORGANIZING UNIT
402
SORTING UNIT
403
CONCATENATING UNIT
404
RETRIEVING UNIT

FIG.11

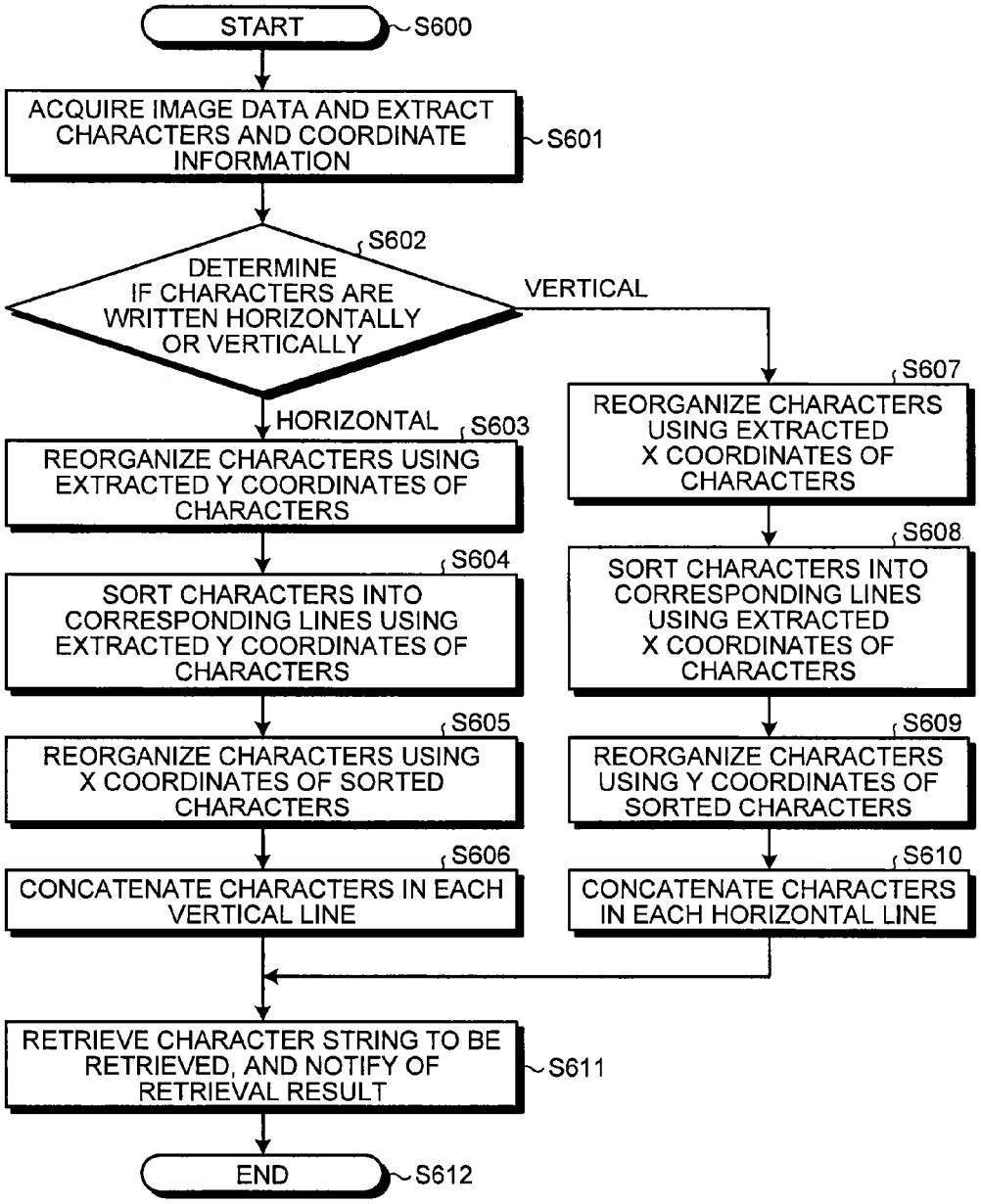

START
S600
ACQUIRE IMAGE DATA AND EXTRACT CHARACTERS AND COORDINATE INFORMATION
S601
S602
DETERMINE IF CHARACTERS ARE WRITTEN HORIZONTALLY OR VERTICALLY
VERTICAL
HORIZONTAL
S603
REORGANIZE CHARACTERS USING EXTRACTED Y COORDINATES OF CHARACTERS
S604
SORT CHARACTERS INTO CORRESPONDING LINES USING EXTRACTED Y COORDINATES OF CHARACTERS
S605
REORGANIZE CHARACTERS USING X COORDINATES OF SORTED CHARACTERS
S606
CONCATENATE CHARACTERS IN EACH VERTICAL LINE
S607
REORGANIZE CHARACTERS USING EXTRACTED X COORDINATES OF CHARACTERS
S608
SORT CHARACTERS INTO CORRESPONDING LINES USING EXTRACTED X COORDINATES OF CHARACTERS
S609
REORGANIZE CHARACTERS USING Y COORDINATES OF SORTED CHARACTERS
S610
CONCATENATE CHARACTERS IN EACH HORIZONTAL LINE
RETRIEVE CHARACTER STRING TO BE RETRIEVED, AND NOTIFY OF RETRIEVAL RESULT
S611
END
S612

FIG.12

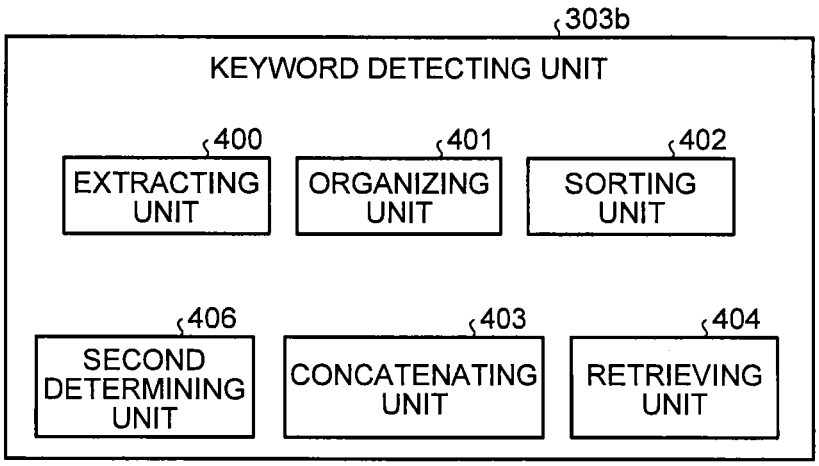
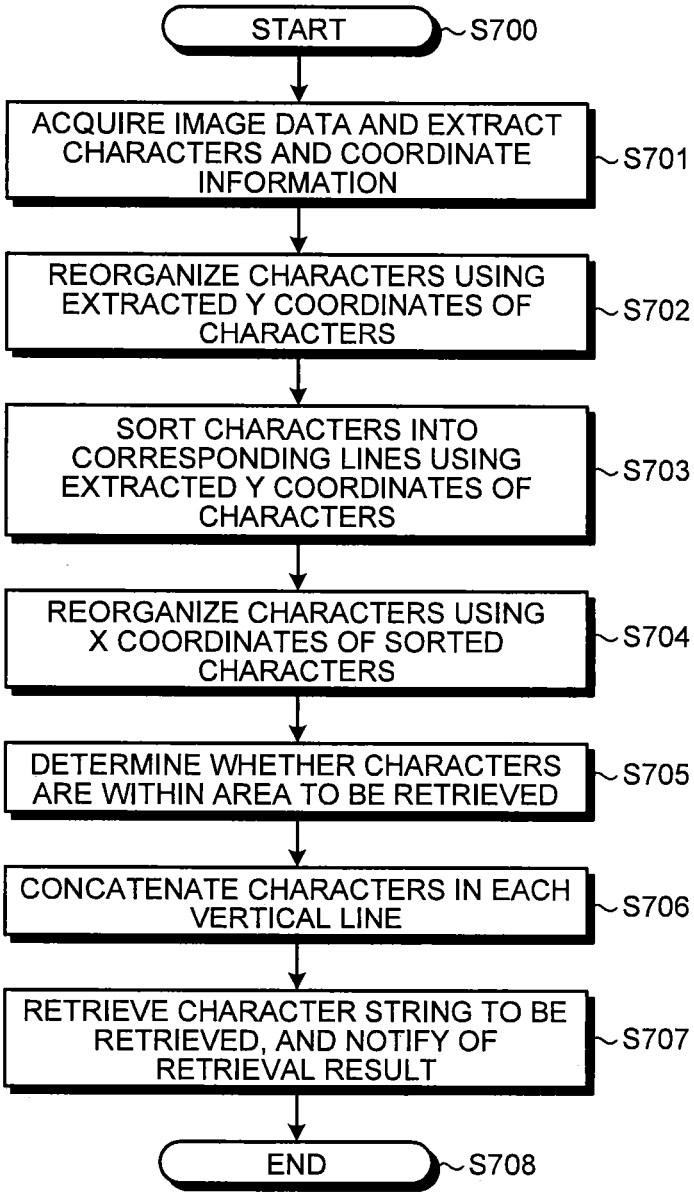

303b
KEYWORD DETECTING UNIT
400
EXTRACTING UNIT
401
ORGANIZING UNIT
402
SORTING UNIT
406
SECOND DETERMINING UNIT
403
CONCATENATING UNIT
404
RETRIEVING UNIT

FIG.13


START
S700
ACQUIRE IMAGE DATA AND EXTRACT CHARACTERS AND COORDINATE INFORMATION
S701
REORGANIZE CHARACTERS USING EXTRACTED Y COORDINATES OF CHARACTERS
S702
SORT CHARACTERS INTO CORRESPONDING LINES USING EXTRACTED Y COORDINATES OF CHARACTERS
S703
REORGANIZE CHARACTERS USING X COORDINATES OF SORTED CHARACTERS
S704
DETERMINE WHETHER CHARACTERS ARE WITHIN AREA TO BE RETRIEVED
S705
CONCATENATE CHARACTERS IN EACH VERTICAL LINE
S706
RETRIEVE CHARACTER STRING TO BE RETRIEVED, AND NOTIFY OF RETRIEVAL RESULT
S707
END
S708

METHOD AND APPARATUS FOR PROCESSING INFORMATION, AND COMPUTER-READABLE STORAGE MEDIUM

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims priority to and incorporates by reference the entire contents of Japanese Patent Application No. 2013-173199 filed in Japan on Aug. 23, 2013 and Japanese Patent Application No. 2014-155475 filed in Japan on Jul. 30, 2014.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a technology for controlling print data outputs, and more particularly to a method, an information processing apparatus, and a computer-readable storage medium that detect specific information from a piece of print data to process the print data.

2. Description of the Related Art

Information processing systems, which are a plurality of printers connected to a network, have been employed in organizations such as companies, government agencies, educational institutions, and hospitals. In such an information processing system, users designate one of the printers for executing a printing process before executing the printing.

For such an information processing system, some disclosures have been made on a technology that determines the conditions for outputting a piece of print data based on a piece of specific information extracted from the print data. For example, Japanese Patent Application Laid-open No. 2011-002881 discloses an information processing system that extracts character strings from a piece of print data in the enhanced metafile (EMF) format, detects a character string that matches a specific keyword, determining an output condition corresponding to the character string, and performs a process corresponding to the output condition, e.g., prints a watermark or replaces the characters.

The order of the characters included in print data in the EMF format is sometimes different from that in a display image of the print data, the display image representing an image actually to be printed on a paper sheet, as illustrated in FIG. **8**, because the print data in the EMF format describes the characters in the order in which the characters are plotted by the application having generated the print data. The information processing system disclosed in Japanese Patent Application Laid-open No. 2011-002881, however, extracts a character string matching a keyword from a piece of print data in which the characters are ordered differently from those in the display image, that is, in which the characters are not reorganized yet. The information processing system is therefore incapable of detecting a keyword accurately.

Therefore, there is a need to provide a method, and an information processing apparatus, and a computer-readable storage medium capable of improving the accuracy of character string detection.

SUMMARY OF THE INVENTION

It is an object of the present invention to at least partially solve the problems in the conventional technology.

According to an embodiment, there is provided a non-transitory computer-readable storage medium with an executable program stored thereon and executed by a computer for processing print data. The program instructs the computer to perform: extracting characters to be printed and coordinate information of the characters from the print data; reorganizing the characters extracted at the extracting using the coordinate information of the characters; sorting the characters extracted at the extracting into corresponding horizontal or vertical lines using the coordinate information of the characters; and concatenating the characters reorganized at the reorganizing and sorted at the sorting.

According to another embodiment, there is provided a method for processing print data. The method includes extracting characters to be printed and coordinate information of the characters from the print data; reorganizing the characters extracted at the extracting using the coordinate information of the characters; sorting the characters extracted at the extracting into corresponding horizontal or vertical lines using the coordinate information of the characters; and concatenating the characters reorganized at the reorganizing and sorted at the sorting.

According to still another embodiment, there is provided an information processing apparatus for processing print data. The information processing apparatus includes an extracting unit that extracts characters to be printed and coordinate information of the characters from the print data; an organizing unit that reorganizes the characters extracted by the extracting unit using the coordinate information of the characters; a sorting unit that sorts the characters extracted by the extracting unit into corresponding horizontal or vertical lines using the coordinate information of the characters; and a concatenating unit that concatenates the characters reorganized by the organizing unit and sorted by the sorting unit.

The above and other objects, features, advantages and technical and industrial significance of this invention will be better understood by reading the following detailed description of presently preferred embodiments of the invention, when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic illustrating an embodiment of an information processing system according to the present invention;

FIG. **2** is a schematic illustrating an embodiment of a hardware configuration of a printer server according to the present invention;

FIG. **3** is a block diagram illustrating functional configuration of the printer server according to a first embodiment of the present invention;

FIG. **4** is a schematic illustrating a functional configuration of a keyword detecting unit according to the first embodiment;

FIG. **5** is a flowchart illustrating a process performed by the keyword detecting unit according to the first embodiment;

FIG. **6** is a conceptual schematic illustrating the process performed by the keyword detecting unit;

FIG. **7** is a schematic illustrating an embodiment of a retrieved information sorting process performed by the keyword detecting unit;

FIG. **8** is a schematic illustrating a display image of a piece of print data, and the print data in the EMF format;

FIG. **9** is a schematic illustrating an example of a concatenation of character strings in a plurality of horizontal lines;

FIG. **10** is a schematic illustrating a functional configuration of a keyword detecting unit according to a second embodiment of the present invention;

FIG. **11** is a flowchart illustrating a process performed by the keyword detecting unit according to the second embodiment;

FIG. **12** is a schematic illustrating a functional configuration of a keyword detecting unit according to a third embodiment of the present invention; and

FIG. **13** is a flowchart illustrating a process performed by the keyword detecting unit according to the third embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will now be explained using some embodiments, but the embodiments described hereunder are not intended to limit the scope of the present invention in any way.

First Embodiment

FIG. **1** is a schematic of an embodiment of an information processing system according to the present invention. This information processing system **100** includes client personal computers (PCs) **112***a*, **112***b*, and **112***c*, a printer server **110**, and printers **120***a*, **120***b*, and **120***c* all connected to each other over a network **130**.

The client PCs **112***a*, **112***b*, and **112***c* are information processing apparatuses that transmit print data with a print request to the printer server **110**, thereby causing the printer server **110** to execute the printing process. The client PCs **112***a*, **112***b*, and **112***c* are running applications capable of generating, editing, and displaying documents, graphs, diagrams, and the like, and transmit data generated by the applications to the printer server **110** as a piece of print data.

In the embodiment, various types of information processing apparatuses, including a desktop PC, a laptop PC, a tablet PC, and a smartphone, may be used as the client PCs **112***a*, **112***b*, and **112***c*. Various types of application software, such as word processing software, spreadsheet software, drawing software, and a document reader, may be used as the applications.

The printer server **110** is an information processing apparatus that determines which one of the printers is to execute printing based on a print request received from the client PCs **112***a*, **112***b*, and **112***c*, and transmits the print data to the printer, thereby causing the printer to output printouts.

The printers **120***a*, **120***b*, and **120***c* are apparatuses that output printouts by executing a printing process in response to an instruction received from the printer server **110**. In the embodiment, various types of printers, including a multiple function printer (MFP) with a scanner, a laser printer, and an inkjet printer, may be used as the printers **120***a*, **120***b*, and **120***c*.

The network **130** is a network that may include an Ethernet (registered trademark) network, an optical network, and a wireless network. The network **130** may also include a wide area network deployed in a secure environment, such as an internet virtual private network (VPN), as well as local area networks (LANs).

The client PCs **112***a*, **112***b*, and **112***c*, the printer server **110**, and the printers **120***a*, **120***b*, and **120***c* can communicate with each other over the network **130**, via communications based on frames, Transmission Control Protocols/Internet Protocols (TCP/IP), or Remote Desktop Protocol (RDP).

FIG. **2** is a schematic of an embodiment of a hardware configuration of the printer server according to the present invention. A hardware configuration of the printer server **110** will now be explained with reference to FIG. **2**.

The printer server **110** includes a central processing unit (CPU) **201**, a read-only memory (ROM) **202**, a random access memory (RAM) **203**, a hard disc drive (HDD) **204**, a network interface (I/F) **205**, and an external device I/F **206**.

The CPU **201** is a processor that controls the operations of the printer server **110**. The ROM **202** is a non-volatile storage device storing therein various types of data. The RAM **203** is a volatile storage device providing an area for executions of various computer programs, executed by the printer server **110**. The HDD **204** is a storage device capable of storing therein various types of data persistently, including the computer program according to the present invention.

The network I/F **205** is a physical interface enabling the printer server **110** to communicate with the network **130**. The external device I/F **206** is a physical interface allowing an external device such as a portable storage device, e.g., a universal serial bus (USB) memory, to be connected to the printer server **110**.

The functions described later are implemented on the printer server **110** by causing the printer server **110** to read the computer program according to the present invention from the HDD **204**, and to load and to execute the computer program on the RAM **203**, under the management of an operation system (OS) of varying types, e.g., WINDOWS (registered trademark) series, Mac (registered trademark) OS, UNIX (registered trademark), and LINUX (registered trademark). The computer program according to the present invention may be described in various types of programming languages such as an assembly language, C, C++, JAVA (registered trademark), JAVA SCRIPT (registered trademark), PERL, RUBY, PYTHON, PHP, VISUAL BASIC (registered trademark), COBOL, and PL/SQL.

FIG. **3** is a block diagram illustrating a functional configuration of the printer server according to the first embodiment. A functional configuration of the printer server **110** will now be explained with reference to FIG. **3**.

The printer server **110** includes a virtual printer driver **300**, an intermediate data storage unit **301**, a print control unit **302**, and a keyword detecting unit **303**.

The virtual printer driver **300** is a unit for creating intermediate data that is a page image from the print data provided from the client PCs **112***a*, **112***b*, and **112***c*. In the embodiment, the virtual printer driver **300** creates a piece of image data in the EMF format from the print data, and stores the image data as well as the job information appended to the print data in the intermediate data storage unit **301**. The image data stored in the intermediate data storage unit **301** includes characters and the coordinate information of the characters.

The print control unit **302** is a unit for determining the printer to which the print data is to be output, and transmitting the print data to the printer. The print control unit **302** refers to the job information stored in the intermediate data storage unit **301**, and transmits the print data to a printer associated with the user name of a print requestor, identification information unique to the client PC, print setting information (e.g., monochromatic print or color print), or the like included in the job information, and causes the printer to execute the printing process.

The print control unit **302** causes the keyword detecting unit **303** to retrieve a specific character string in the image data stored in the intermediate data storage unit **301**. The

print control unit **302** provides detection conditions such as a character string to be detected and an area to be retrieved to the keyword detecting unit **303** before causing the keyword detecting unit **303** to perform the retrieval.

The keyword detecting unit **303** retrieves a specific character string from the image data that is the intermediate data, and notifies the print control unit **302** of the result, in response to an instruction from the print control unit **302**. FIG. **4** is a schematic of a functional configuration of the keyword detecting unit **303** according to the first embodiment. The keyword detecting unit **303** includes an extracting unit **400**, an organizing unit **401**, a sorting unit **402**, a concatenating unit **403**, and a retrieving unit **404**.

The extracting unit **400** is a unit for extracting characters to be printed and the coordinate information of the characters from the image data that is intermediate data. The extracting unit **400** acquires the image data from the intermediate data storage unit **301**, and extracts characters found in the area to be retrieved that is specified as a detection condition, and extracts the coordinate information of the characters.

The organizing unit **401** is a unit for reorganizing the characters extracted from the image data. The organizing unit **401** reorganizes the characters using the X coordinates and Y coordinates of the characters, these coordinates provided as the coordinate information of the extracted characters.

The sorting unit **402** is a unit for sorting the characters extracted from the image data into corresponding horizontal or vertical lines. The sorting unit **402** sorts the characters into the corresponding horizontal lines with reference to the Y coordinates of the extracted characters. In the first embodiment, the extracted characters are sorted in the horizontal lines to process the character strings written horizontally, but the sorting unit **402** may sort the extracted characters into vertical lines using the X coordinate of the extracted characters, in another embodiment in which the character strings written vertically are processed.

The concatenating unit **403** is a unit for concatenating the characters extracted from the image data in each of the horizontal or vertical lines. In the embodiment, the concatenating unit **403** concatenates the characters in each of the horizontal lines, the characters having been sorted into the corresponding horizontal lines by the sorting unit **402**, and having reorganized with reference to the X coordinates by the organizing unit **401**. In another embodiment, the concatenating unit **403** concatenates the characters in each of the vertical lines, the characters having been sorted into the corresponding vertical lines by the sorting unit **402**, and having reorganized with reference to the Y coordinates by the organizing unit **401**.

The retrieving unit **404** is a unit for retrieving characters having been extracted from the image data. The retrieving unit **404** retrieves a character string to be detected specified as a detection condition from the character strings concatenated by the concatenating unit **403**, and notifies the print control unit **302** of the retrieval result.

In the embodiment illustrated in FIG. **4**, the functional units of the keyword detecting unit **303** are implemented on the printer server **110**, but, in another embodiment, these functional units may be implemented on separate information processing apparatuses.

FIG. **5** is a flowchart illustrating process performed by the keyword detecting unit **303** implemented on the printer server **110** according to the first embodiment. The keyword detecting process will now be explained with reference to FIG. **5**.

The process illustrated in FIG. **5** starts at Step S**500**. At Step S**501**, the extracting unit **400** acquires a piece of image data from the intermediate data storage unit **301**, and extracts the characters that are within the area to be retrieved that is specified as a detection condition, and the coordinate information of the characters. At Step S**502**, the organizing unit **401** reorganizes the characters using the Y coordinates of the respective characters, the Y coordinates being provided as the coordinate information of the extracted characters. At Step S**503**, the sorting unit **402** sorts the character into the corresponding horizontal lines using the Y coordinates of the respective extracted characters.

At Step S**504**, the organizing unit **401** reorganizes the characters having been sorted into the corresponding horizontal lines, using the X coordinates of the respective characters, the X coordinates being provided as the coordinate information of the characters. At Step S**505**, the concatenating unit **403** concatenates the characters in each of the horizontal lines, the characters having been reorganized at Step S**504**. At Step S**506**, the retrieving unit **404** retrieves a character string to be detected specified as a detection condition from the character strings concatenated at Step S**505**, and notifies the print control unit **302** of the retrieval result, and the process is ended at Step S**507**.

The process illustrated in FIG. **5** is a process performed when the character strings are written horizontally in the image data. When character strings are written vertically in the image data, the keyword detecting unit **303** reorganizes the characters using the X coordinates provided as the coordinate information, sorts the characters into the corresponding vertical lines, reorganizes the characters again using the Y coordinates, and concatenates the characters in each of the vertical lines.

FIG. **6** is a conceptual schematic illustrating a process executed by the keyword detecting unit **303**. The process executed prior to the keyword retrieval process will now be explained with reference to FIG. **6**.

Retrieved information **601** represents characters and the coordinate information of the characters extracted from a piece of image data that is intermediate data by the keyword detecting unit **303**. The retrieved information **601** includes a plurality of characters ("F", "G", "H", "I", "J", "B", "D", "E", "A", "C"), and the coordinate information of these characters. The keyword detecting unit **303** reorganizes the characters included in the retrieved information **601** with reference to the Y coordinates of the respective characters. In the embodiment illustrated in FIG. **6**, the characters are reorganized in the ascending order of the Y coordinates.

The keyword detecting unit **303** then sorts the characters and the coordinate information included in retrieved information **602**, having the characters and their coordinate information reorganized with reference to the Y coordinates, into the corresponding horizontal lines. In the embodiment illustrated in FIG. **6**, the keyword detecting unit **303** determines that the characters with the same Y coordinate belong to the same horizontal line. In other words, the keyword detecting unit **303** determines that the characters having a Y coordinate of "1" ("B", "D", "E", "A", "C") belong to line 1, and determines that the characters having a Y coordinate of "2" ("F", "G", "H", "I", "J") belong to line 2.

The keyword detecting unit **303** then reorganizes the characters included in the retrieved information **603**, having the characters and their coordinate information sorted into the corresponding horizontal lines, with reference to the X coordinates of the characters. In the embodiment illustrated in FIG. **6**, the characters are reorganized in the ascending order of the X coordinates.

The keyword detecting unit **303** then generates retrieved information **605** by concatenating the characters in each of the horizontal lines in retrieved information **604** having the characters and their coordinate information reorganized in with reference to the X coordinates, and performs the keyword detecting process on the retrieved information **605**. In the embodiment illustrated in FIG. **6**, the keyword detecting unit **303** retrieves a character string of "ABCDE" in line 1 and a character string of "FGHIJ" in line 2. In this manner, the keyword detecting unit **303** can retrieve character strings arranged in the same order as in a display image **600**, so that the accuracy of keyword detection can be improved.

FIG. **7** is a schematic illustrating an embodiment of a retrieved information sorting process performed by the keyword detecting unit **303**. The embodiment of the retrieved information sorting process will now be explained with reference to FIG. **7**.

A display image **700** is an image output when the print data is actually printed out. In the display image **700**, "NAME" are in bold characters and ":YAMADA" are in standard characters, and these two character strings are represented in the same horizontal line, but have different font sizes. Retrieved information **701** is retrieved information in which the characters are reorganized with reference to the Y coordinates. In the retrieved information **701**, "N", "A", "M" and "E" that are bold characters have Y coordinate of "1", and ":", "Y", "A", "M", "A", "D", and "A" have a Y coordinate of "2". In the embodiment illustrated in FIG. **7**, because the character string "NAME" and the character string ":YAMADA" have different character thicknesses and sizes, these character strings have different Y coordinates.

The keyword detecting unit **303** sorts the characters and the coordinate information included in the retrieved information **701** into the corresponding horizontal lines. Determining that the characters with the same Y coordinate belong to the same horizontal line, the character string "NAME" and the character string ":YAMADA" would be determined to belong to different horizontal lines, as illustrated as retrieved information **705**, **706**, and **707**, and the keyword detecting unit **303** would be incapable of sorting the characters correctly. In the embodiment, therefore, the keyword detecting unit **303** refers to the Y coordinates of the respective characters and determines that characters belong to the same horizontal line if the difference between these Y coordinates is smaller than a predetermined value.

To explain specifically, in the embodiment illustrated in FIG. **7**, because the difference between the Y coordinate "1" of the characters "N", "A", "M" and "E" and the Y coordinate "2" of the characters ":", "Y", "A", "M", "A", "D", and "A" is one, and is equal to or less than the predetermined value (e.g., 10), the keyword detecting unit **303** determines that these characters belong to the same horizontal line. The predetermined value is preferably any value that is likely to be taken by the difference between the Y coordinates of characters belong to the same horizontal line.

In the manner described above, in the first embodiment, when the keyword detecting unit **303** sorts the characters into the corresponding horizontal lines, the keyword detecting unit **303** determines that the characters with approximately the same Y coordinates belong to the same horizontal line, without determining that only the characters with the same Y coordinate belong to the same horizontal line. The keyword detecting unit **303** can therefore sort the characters correctly in a manner matching those in the display image **700**, even when the characters in different sizes or thicknesses are written in the same horizontal line.

Presentation of the character strings in the respective horizontal lines (or the vertical lines), each of the character strings concatenated by the concatenating unit **403**, is not limited to a plurality of character strings represented in the respective horizontal lines (or vertical lines), as illustrated in the retrieved information **605** in FIG. **6**. For example, a plurality of character strings in the respective horizontal lines (or vertical lines) may be concatenated to one character string in one horizontal line (or vertical line), as illustrated in retrieved information **605***a* in FIG. **9**. Such concatenation allows a keyword to be detected easily. Furthermore, the concatenating unit **403** does not need to concatenate all of a plurality of character strings, and may concatenate at least some of the character strings.

Second Embodiment

An information processing system according to a second embodiment of the present invention will now be explained, focusing on the difference from the information processing system according to the first embodiment. The information processing system according to the second embodiment has the same configuration as the information processing system **100** illustrated in FIG. **1**. The printer server **110** according to the second embodiment has the same hardware configuration as the printer server **110** illustrated in FIG. **2**. The printer server **110** according to the second embodiment has the same functional configuration as the printer server **110** illustrated in FIG. **3**, except that a keyword detecting unit **303***a*, which is described later, illustrated in FIG. **10** is provided instead of the keyword detecting unit **303**. Explained in the second embodiment is an operation of determining whether the characters to be extracted from a piece of image data are written horizontally or vertically, before the characters are reorganized.

FIG. **10** is a schematic of a functional configuration of the keyword detecting unit according to the second embodiment. The functional configuration of the keyword detecting unit **303***a* according to the second embodiment will now be explained with reference to FIG. **10**.

As illustrated in FIG. **10**, the keyword detecting unit **303***a* according to the second embodiment includes an extracting unit **400**, an organizing unit **401**, a sorting unit **402**, a concatenating unit **403**, a retrieving unit **404**, and a first determining unit **405**. The operations of the extracting unit **400**, the organizing unit **401**, the concatenating unit **403**, and the retrieving unit **404** according to the second embodiment are the same as those of the extracting unit **400**, the organizing unit **401**, the concatenating unit **403**, and the retrieving unit **404**, respectively, according to the first embodiment.

The sorting unit **402** is a unit for sorting the characters extracted from the image data into corresponding horizontal or vertical lines. The sorting unit **402** sorts the characters into the corresponding horizontal lines or vertical lines with reference to the Y coordinates or the X coordinates of the extracted characters, respectively.

The first determining unit **405** is a unit for determining if the characters to be printed extracted from the image data by the extracting unit **400** are written horizontally or vertically.

As illustrated in FIG. **10**, the functional units of the keyword detecting unit **303***a* are implemented on the printer server **110**, but these functional units may be implemented on separate information processing apparatuses.

FIG. **11** is a flowchart illustrating process performed by the keyword detecting unit according to the second embodiment. The keyword detecting process will now be explained with reference to FIG. **11**.

The process illustrated in FIG. **11** starts at Step S**600**. At Step S**601**, the extracting unit **400** acquires a piece of image data from the intermediate data storage unit **301**, and extracts the characters that are within the area to be retrieved that is specified as a detection condition, and the coordinate information of the characters. At Step S**602**, the first determining unit **405** determines whether the characters extracted by the extracting unit **400** are written horizontally or vertically. If the characters extracted by the extracting unit **400** are written horizontally (horizontal at Step S**602**), the system control goes to Step S**603**. If the characters extracted by the extracting unit **400** are written vertically (vertical at Step S**602**), the system control goes to Step S**607**.

At Step S**603**, the organizing unit **401** reorganizes the characters using the Y coordinates of the respective characters, the Y coordinates being provided as the coordinate information of the extracted characters. At Step S**604**, the sorting unit **402** sorts the character into the corresponding horizontal lines using the Y coordinates of the respective extracted characters.

At Step S**605**, the organizing unit **401** reorganizes the characters having been sorted into the corresponding horizontal lines, using the X coordinates of the respective characters, the X coordinates being provided as the coordinate information of the characters. At Step S**606**, the concatenating unit **403** concatenates the characters in each of the horizontal lines, the characters having been reorganized at Step S**605**.

At Step S**607**, the organizing unit **401** reorganizes the characters using the X coordinates of the respective characters, the X coordinates being provided as the coordinate information of the extracted characters. At Step S**608**, the sorting unit **402** sorts the characters into the corresponding vertical lines, using the extracted X coordinates of the characters.

At Step S**609**, the organizing unit **401** reorganizes the characters sorted into the corresponding vertical lines using the Y coordinates of the respective characters, the Y coordinates being provided as the coordinate information of the characters. At Step S**610**, the concatenating unit **403** concatenates the characters in each of the vertical lines reorganized at Step S**609**.

At Step S**611**, the retrieving unit **404** retrieves a character string to be detected specified as a detection condition from the character strings concatenated at Step S**606** or Step S**610**, and notifies the print control unit **302** of the retrieval result, and the process is ended at Step S**612**.

As described above, in the second embodiment, the first determining unit **405** determines whether the characters to be printed extracted from a piece of image data by the extracting unit **400** are written horizontally or vertically, and the characters are reorganized and sorted into the corresponding horizontal or vertical lines based on the determination result. The characters are then reorganized using the X coordinates or Y coordinates, and the characters in each of the horizontal or vertical lines are concatenated. In this manner, regardless of whether a character string is written horizontally or vertically in the image data, the first determining unit **405** can determine if the character string is written in which direction, so that the retrieval can be performed in the character strings arranged in the same order as those in the display image. The keyword detection accuracy can therefore be further improved.

Third Embodiment

The information processing system according to a third embodiment of the present invention will now be explained, focusing on the difference from the information processing system according to the first embodiment. The information processing system according to the third embodiment has the same configuration as the information processing system **100** illustrated in FIG. **1**. The printer server **110** according to the third embodiment has the same hardware configuration as the printer server **110** illustrated in FIG. **2**. The printer server **110** according to the third embodiment has the same functional configuration as the printer server **110** illustrated in FIG. **3**, except that a keyword detecting unit **303***b*, which is described later, illustrated in FIG. **12** is provided instead of the keyword detecting unit **303**. Explained in the third embodiment is an operation of concatenating only the characters in the area to be retrieved, among those extracted from a piece of image data, reorganized, and sorted.

FIG. **12** is a schematic of a functional configuration of the keyword detecting unit according to the third embodiment. The functional configuration of the keyword detecting unit **303***b* according to the third embodiment will now be explained with reference to FIG. **12**.

As illustrated in FIG. **12**, the keyword detecting unit **303***b* according to the third embodiment includes the extracting unit **400**, the organizing unit **401**, the sorting unit **402**, the concatenating unit **403**, the retrieving unit **404**, and a second determining unit **406**. The organizing unit **401**, the sorting unit **402**, and the retrieving unit **404** according to the third embodiment are the same as those of the organizing unit **401**, the sorting unit **402**, and the retrieving unit **404** according to the first embodiment.

The extracting unit **400** is a unit for acquiring a piece of image data that is intermediate data from the intermediate data storage unit **301**, and extracting characters to be printed and the coordinate information of the characters from the image data.

The second determining unit **406** is a unit for determining if the characters reorganized by the organizing unit **401** and sorted by the sorting unit **402** are within the area to be retrieved, specified as a retrieval condition.

The concatenating unit **403** is a unit for concatenating characters determined to be in the area to be retrieved in the units of a horizontal or vertical line, such a determination made by the second determining unit **406**, among those extracted from the image data. For example, the concatenating unit **403** concatenates the characters in the area to be retrieved in the units of a horizontal line, among the characters sorted into the corresponding horizontal lines by the sorting unit **402** and reorganized with reference to the X coordinates by the organizing unit **401**.

As illustrated in FIG. **12**, the functional units of the keyword detecting unit **303***b* are implemented on the printer server **110**, but these functional units may be implemented on separate information processing apparatuses.

FIG. **13** is a flowchart illustrating a process performed by the keyword detecting unit according to the third embodiment. This keyword retrieval process will now be explained with reference to FIG. **13**.

The process illustrated in FIG. **13** starts at Step S**700**. At Step S**701**, the extracting unit **400** acquires a piece of image data from the intermediate data storage unit **301**, and extracts the characters to be printed and the coordinate information of the characters from the image data. At Step S**702**, the organizing unit **401** reorganizes the characters using the Y coordinates of the respective characters, the Y

coordinates being provided as the extracted coordinate information of the characters. At Step S703, the sorting unit **402** sorts the characters into the corresponding horizontal lines using the extracted Y coordinates of the characters.

At Step S704, the organizing unit **401** reorganizes the characters having been sorted into the corresponding horizontal lines, using the X coordinates of the respective characters, the X coordinates being provided as the coordinate information of the characters. At Step S705, the second determining unit **406** determines whether the characters reorganized at Step S704 are within the area to be retrieved specified as a retrieval condition. At Step S706, the concatenating unit **403** concatenates the characters determined to be within the area to be retrieved at Step S705, in the units of a horizontal line. At Step S707, the retrieving unit **404** retrieves a character string to be detected specified as a detection condition from the character strings concatenated at Step S706, and notifies the print control unit **302** of the retrieval result, and the process is ended at Step S708.

The process illustrated in FIG. **13** is a process performed when the character strings are written horizontally in the image data. When character strings are written vertically in the image data, the keyword detecting unit **303** reorganizes the characters using the X coordinates provided as the coordinate information, sorts the characters into the corresponding vertical lines, reorganizes the characters again using the Y coordinates, and concatenates the characters in each of the vertical lines.

In the manner described above, in the third embodiment, the second determining unit **406** determines whether the characters reorganized by the organizing unit **401** and sorted by the sorting unit **402** are within the area to be retrieved specified as a retrieval condition, and the concatenating unit **403** concatenates the characters determined to be within the area to be retrieved. In this manner, only the characters that are within a specified area to be retrieved are concatenated, without concatenating the characters in each of the horizontal or vertical lines for all of the character strings written in the image data, and a keyword is retrieved from the concatenations, so that keyword detection efficiency can be improved.

The extracting unit **400**, the organizing unit **401**, the sorting unit **402**, the concatenating unit **403**, the retrieving unit **404**, the first determining unit **405**, and the second determining unit **406** according to the embodiments described above may be partially or entirely implemented as a hardware circuit, instead of a computer program being a piece of software.

When at least one of the extracting unit **400**, the organizing unit **401**, the sorting unit **402**, the concatenating unit **403**, the retrieving unit **404**, the first determining unit **405**, and the second determining unit **406** according to the embodiments is implemented by execution of a computer program, the computer program is provided in a manner embedded in the ROM **202** in advance. The computer program executed on the printer server **110** may be recorded and provided in a computer-readable storage medium such as a compact disc read-only memory (CD-ROM), a flexible disk (FD), a compact disc recordable (CD-R), and a digital versatile disc (DVD), as an installable or executable file. The computer program executed on the printer server **110** may be stored in a computer connected to a network such as the Internet, and made available for download over the network. The computer program executed on the printer server **110** may be provided or distributed over a network such as the Internet. The computer program executed on the printer server **110** has a modular structure including at least one of the extracting unit **400**, the organizing unit **401**, the sorting unit **402**, the concatenating unit **403**, the retrieving unit **404**, the first determining unit **405**, and the second determining unit **406**. As actual hardware, by causing the CPU **201** to read the computer program from the ROM **202** or the HDD **204**, for example, and to execute the computer program, the functional units described above are loaded and generated on the main memory.

According to the embodiments, use of the units described above allows characters to be retrieved to be reorganized in the same arrangement as those in a display image, so that the accuracy of character string detection can be improved.

Although the invention has been described with respect to specific embodiments for a complete and clear disclosure, the appended claims are not to be thus limited but are to be construed as embodying all modifications and alternative constructions that may occur to one skilled in the art that fairly fall within the basic teaching herein set forth.

What is claimed is:

1. A non-transitory computer-readable storage medium with a program stored thereon and executed by a computer for processing print data, the program instructing the computer to perform a method, the method comprising:

extracting characters to be printed and coordinate information of the characters from the print data;

reorganizing the characters extracted at the extracting using the coordinate information of the characters;

grouping the reorganized characters into corresponding horizontal or vertical lines using the coordinate information of the characters;

first concatenating the grouped characters into a plurality of character strings within the corresponding horizontal or vertical lines; and

second concatenating the plurality of character strings in the corresponding horizontal or vertical lines into a single character string in one horizontal or vertical line.

2. The non-transitory computer-readable storage medium according to claim **1**, wherein the grouping includes determining that the characters with same or approximately same X coordinates or Y coordinates represented in the coordinate information of the reorganized characters belong to a same horizontal or vertical line.

3. The non-transitory computer-readable storage medium according to claim **1**, wherein the reorganizing includes reorganizing the extracted characters in a same order as the characters in a display image of the print data.

4. The non-transitory computer-readable storage medium according to claim **1**, wherein:

the method further includes determining whether the extracted characters are written horizontally or vertically,

the reorganizing includes reorganizing the extracted characters based on a determination result of the determining,

the grouping includes grouping the reorganized characters into corresponding horizontal or vertical lines based on the determination result, and

the first concatenating includes concatenating the grouped characters based on the determination result.

5. The non-transitory computer-readable storage medium according to claim **1**, wherein

the method further includes determining whether the characters reorganized at the reorganizing and grouped by the grouping are within a specified area to be retrieved in the print data, and

the first concatenating includes concatenating the characters determined to be within the specified area to be retrieved.

6. The non-transitory computer-readable storage medium according to claim **1**, wherein the method further includes retrieving the single character string concatenated at the second concatenating.

7. The non-transitory computer-readable storage medium according to claim **1**, wherein the first concatenation of the grouped characters is based on same X coordinates.

8. The non-transitory computer-readable storage medium according to claim **1**, wherein the first concatenation of the grouped characters is based on same Y coordinates.

9. The non-transitory computer-readable storage medium according to claim **1**, wherein the first concatenation of the grouped characters is based on same X coordinates or same Y coordinates.

10. A method for processing print data, the method comprising:

extracting, by circuitry, characters to be printed and coordinate information of the characters from the print data;

reorganizing, by the circuitry, the characters extracted at the extracting using the coordinate information of the characters;

grouping, by the circuitry, the reorganized characters into corresponding horizontal or vertical lines using the coordinate information of the characters;

first concatenating, by the circuitry, the grouped characters into a plurality of character strings within the corresponding horizontal or vertical lines; and

second concatenating, by the circuitry, the plurality of character strings in the corresponding horizontal or vertical lines into a single character string in one horizontal or vertical line.

11. An information processing apparatus for processing print data, the information processing apparatus comprising:

circuitry configured to:

extract characters to be printed and coordinate information of the characters from the print data;

reorganize the extracted characters using the coordinate information of the characters;

group the reorganized characters into corresponding horizontal or vertical lines using the coordinate information of the characters;

first concatenate the grouped characters into a plurality of character strings within the corresponding horizontal or vertical lines; and

second concatenate the plurality of character strings in the corresponding horizontal or vertical lines into a single character string in one horizontal or vertical line.

12. The information processing apparatus according to claim **11**, wherein the circuitry is further configured to determine that the characters with same or approximately same X coordinates or Y coordinates represented in the coordinate information of the reorganized characters belong to a same horizontal or vertical line.

13. The information processing apparatus according to claim **11**, wherein the circuitry is further configured to reorganize the extracted characters in a same order as the characters in a display image of the print data.

14. The information processing apparatus according to claim **11**, wherein

the circuitry is further configured to:

determine whether the extracted characters are written horizontally or vertically,

reorganize the extracted characters based on a result of the determination, and

group the reorganized characters into corresponding horizontal or vertical lines based on the determination result, and

the first concatenation includes a concatenation of the grouped characters based on the determination result.

15. The information processing apparatus according to claim **11**, wherein

the circuitry is further configured to:

determine whether the reorganized and grouped characters are within a specified area to be retrieved in the print data, and

the first concatenation includes a concatenation of the characters determined to be within the specified area to be retrieved.

16. The information processing apparatus according to claim **11**, wherein the circuitry is further configured to retrieve the single character string from the second concatenation.

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